SCIENCE

VOL. LXXI — FRIDAY, JANUARY 3, 1930 — No. 1827

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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. — Garrison, N. Y.

Annual Subscription, $6.00 — Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

THE DISCOVERY OF TERTIARY MAN[1]

By Dr. HENRY FAIRFIELD OSBORN

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THE discovery of Quaternary man was the central biological achievement of the nineteenth century. For twenty-four centuries the largely speculative idea of a natural rather than a supernatural origin of man had been slowly developing through the observations of zoologists and the dissections of comparative anatomists. From the time of Anaximander (547 B. C.), of Galen (131 A. D.), of Leibnitz (1700), of Buffon (1755), of Goethe (1790), of Erasmus Darwin (1794), of Lamarck (1809), of Chambers (1844), of Leidy (1847–1873) to that of Charles Darwin (1859–1871), one bit of evidence after another was added from comparative anatomy, until in the sixteenth century comparative zoology contributed the strong likeness to man of the anthropoid apes—the chimpanzee and gorilla of Africa, the gibbon and orang of eastern Asia. The most significant and prophetic observations in comparative anatomy were those of Goethe in the discovery of a separate intermaxillary bone in the upper jaw of man which both he and Leidy rightly interpreted as linking men with the apes and other primates in which the upper jaw is composed of two bones. Up to 1859 the relatively new science of paleontology had contributed nothing, because the female Neanderthal skull of Gibraltar in 1848 and the male Neanderthal calvarium of Germany in 1856 were misinterpreted by Virchow, Huxley and other anatomists.

I emphasize comparative anatomy and zoology, for as regards *direct* evidence our speculative position toward Tertiary man in 1929 is very much the same as Lamarck's and Darwin's speculative position toward Quaternary man between 1809 and 1871, because we are still largely dependent upon the facts afforded by

[1] Address of the retiring president of the American Association for the Advancement of Science, Des Moines, December 27, 1929.

comparative anatomy and comparative zoology, in the absence of direct paleontologic evidence in Middle and Lower Tertiary time. This statement is not true as regards *indirect* evidence, for human paleontology is now in a very strong position even to the very base of Quaternary time, a period estimated by geologists at 1,250,000 years. Fossil human remains of over 100 Quaternary individuals have been found including: *Palaeanthropus neanderthalensis* of Neanderthal, 48+; *Homo sapiens* of Cro-Magnon and Chancellade, 42; 2 of the Trinil race of Java, *Pithecanthropus erectus;* 2 of the Piltdown race, *Eoanthropus dawsoni;* 1 of the Heidelberg race, *Palaeanthropus heidelbergensis,* also 1 and possibly 2 more individuals recently reported by Freudenberg under the name *Hemianthropus;* 27 of the recently discovered Chinese *Sinanthropus pekinensis* (Schlosser, 1903; Zdansky, 1926; Black, 1927–1928). All these human fossils constitute a firm and broad human paleontology for Quaternary time and the close of Tertiary time. Each generic name, *e.g., Palaeanthropus, Pithecanthropus, Eoanthropus, Sinanthropus* and *Homo,* demonstrates an entirely distinct branch of the fossil human families of Quaternary time; each branch is known to paleontologists as a *phylum,* and the special scientific analysis of these several branches is termed *phylogeny.* Phylogeny is a relatively new and very important branch of biology, the principles of which were entirely unknown to Darwin (1859–1871) and only in part known to Huxley, as they are now revealed by the brilliant and world-wide discoveries by invertebrate and vertebrate paleontologists. My forecast of the Tertiary anatomy and habits of the "dawn-man" is greatly influenced by our direct knowledge of the phylogeny of other mammals.

As Quaternary fossil man was the central biological contribution of the nineteenth century, so Tertiary man constitutes the goal and peak of biological discovery in the twentieth century. Thus far I have been dealing with well-known facts because these Quaternary fossil men have become household words all over the world. On the other hand, the discussion of Tertiary man carries us into the unknown, into one of the most interesting fields of human speculation and anatomical controversy, into several divergent camps of human opinion and interpretation, along several great lines of comparative anatomy of the principal organs concerned, namely, the brain, the skull and jaws, the limbs, the hands and feet. Both with Lamarck and Darwin the "ape-man" descent was never more than a working hypothesis based upon the closer approach of the anthropoid apes to man than that observed in any other group, for want of any positive data. Both Lamarck and Darwin postulated a *reversible* evolution in function and structure whereby an animal with all the psychical and anatomical adaptations of arboreal apes could secondarily take on a gradual change of habit and function and gradually enter a new erect career with radical changes in habit and in mind as well as in the anatomy of limbs, hands and feet. Darwin's starting-point (1871), after picturing as our ancestor a hypothetical ape not far from a primitive Miocene chimpanzee, concluded with the following all-important sentence both as to habit and habitat:

> *The foot was then prehensile, judging from the condition of the great toe in the foetus; and our progenitors, no doubt, were arboreal in their habits, and frequented some warm, forest-clad land.*

Quite recently (August, 1927), before the British Association, President Keith summed up this hypothesis as follows:

> DATE OF MAN'S EMERGENCE. It is useless to go to strata still older than the Miocene in search of man's emergence; in such strata we have found only fossil traces of emerging anthropoids. All the evidence now at our disposal supports the conclusion that man has arisen, as Lamarck and Darwin suspected, from an anthropoid ape not higher in the zoological scale than a chimpanzee, and that the date at which human and anthropoid lines of descent began to diverge lies near the beginning of the Miocene period. On our modest scale of reckoning, that gives man the respectable antiquity of about one million years.

This Lamarck-Darwin working hypothesis has been greatly strengthened and in large measure adopted by an army of human and comparative anatomists including all the leading and most brilliant men of our time such as Sir Arthur Keith (1927), Dr. G. Elliot Smith (1926–1929), Professors William King Gregory, Dudley J. Morton and Robert M. Yerkes, as well as by a host of other able but less widely known anatomists. So great has been the force of nearly unanimous adherence to the Lamarck-Darwin hypothesis that it has gained world-wide acceptance even among the most intelligent scientists, as may be seen in passages in two outstanding works of the present decade, Eddington's "The Nature of the Physical World" (1928) and Jeans's "The Universe Around Us" (1929). A parallel instance of the world-wide assumption of a working hypothesis is that of Lamarck's hypothesis of the inheritance of acquired characters as the prime cause of evolution. Although never demonstrated, the Lamarckian hypothesis was universally accepted until Weismann gave it a death blow in 1880. Such may be the fate of the "ape-man" hypothesis.

I was myself rather suddenly converted to the opposite "dawn-man" hypothesis in a roundabout manner. When in 1919 after years of search the American Mu-

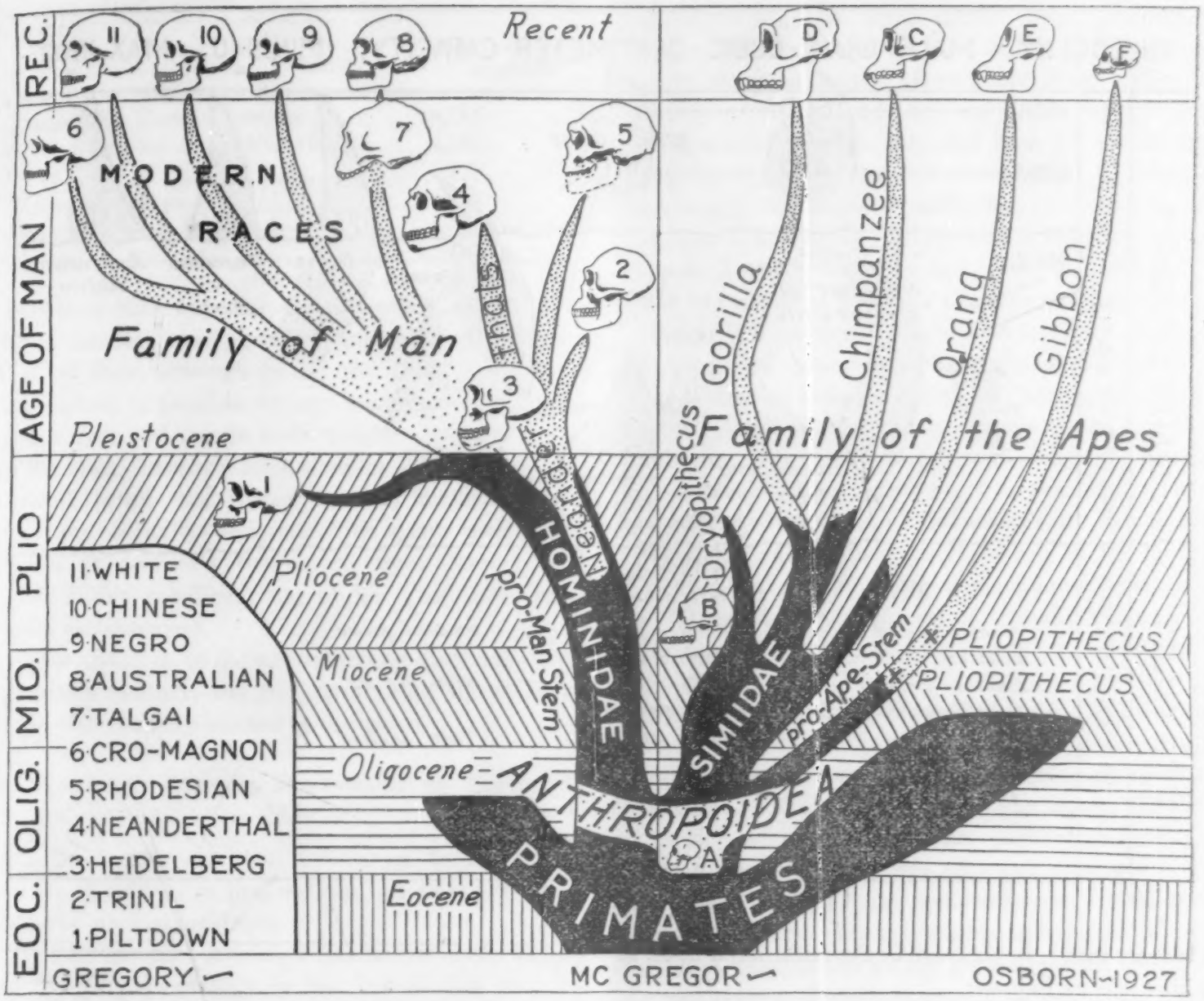

FIG. 1. OSBORN'S PRESENT THEORY OF THE ASCENT AND PHYLOGENY OF MAN.

Left: Family of Man (*Hominidae*), dividing into the Neanderthaloid and modern racial stocks; present geologic location of the Piltdown, Heidelberg, Trinil, Neanderthal and Rhodesian fossil races. Right: Family of the Apes (*Simiidae*), including the Pliocene and Miocene dryopithecoids nearest the ancestral stock of the Anthropoidea, also the lines leading to the gorilla, orang, chimpanzee and gibbon. Below: Anthropoidea, the common Oligocene ancestors of the *Hominidae* and of the *Simiidae*.

seum discovered in Middle Pliocene time the complete skeleton of a horse, named *Pliohippus leidyanus*, a perfect horse in all except name and perhaps color, the bearing of this case of precocious adaptation on human descent flashed across my mind, and before a meeting of the National Academy of Sciences I predicted that the greatest surprise in store for twentieth-century science would be in the discovery of a large-brained Tertiary man! This anatomical prophecy has unexpectedly been confirmed by recent paleontologic evidence that *Eoanthropus*, the "dawn-man" of Sussex, is of Upper Pliocene or Tertiary age.

The large brain of *Eoanthropus* suggests as our first quota of counter-evidence a review of our greatly enriched knowledge of the Quaternary fossil brain.

BRAIN SURPRISES OF QUATERNARY DISCOVERY

These surprises arise from the profound researches and independent discoveries of Dubois, Smith Woodward, Boule, Keith, McGregor, Black, Economo and Lebouceq, to which honor roll we should add Frederick Tilney's "The Brain from Ape to Man" (1928). The six outstanding points as to the brain are as follows: (1) that certain races of fossil man of the last 1,250,000 years had a brain cube equal to or greater than that of modern man; (2) that the much-despised cave man (*Palaeanthropus*) was inferior to ourselves neither in brain cube nor in hand ability, although far inferior to ourselves in civilization; (3) that certain of the cave men (*Homo sapiens*, Cro-Magnon) were our superiors both in average brain capacity and in average artistic ability; (4) that at the close of Tertiary time there lived a race (*Eoanthropus dawsoni*) with a brain cube equal to the minimum of that of the living Veddahs, Papuans and native Australians; (5) that the ratio of human brain weight to body weight in Quaternary time was apparently the same as it is to-day, namely, 1:50

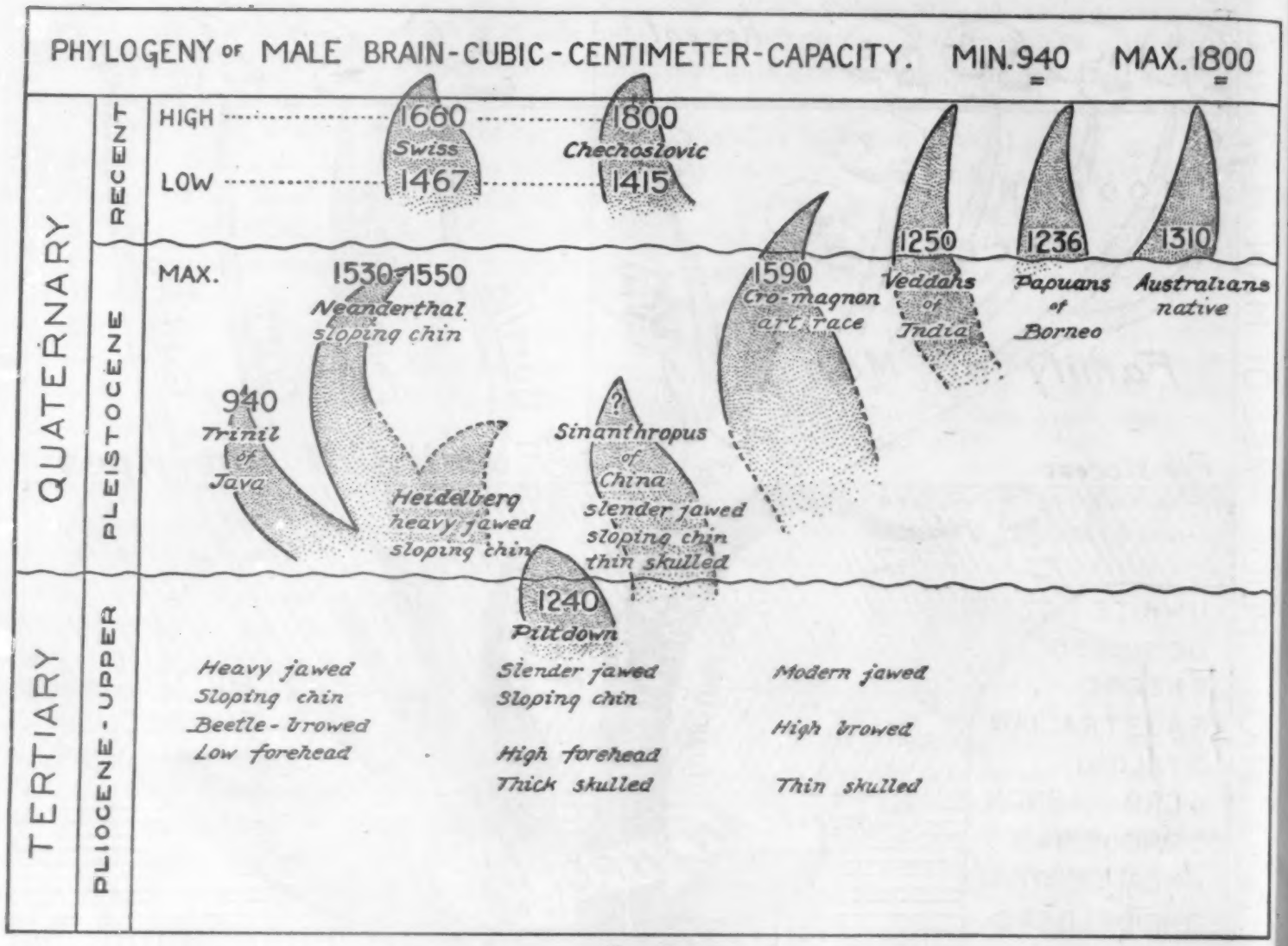

FIG. 2

(Weber, 1896), in contrast to the anthropoid apes, in which it is as follows:

	Brain to body weight ratio
Super-arboreal Gibbon of southeast Asia (130 gr.)	1: 66 or 1: 73
Arboreal Chimpanzee of west Africa (412 gr.)	1: 51 or 1: 61
Super-arboreal Orang of Borneo (400 gr.)	1: 183 or 1: 194
Terrestrial-arboreal Goriila of central and west Africa (565 gr.)	1: 150 or 1: 200

(6) as Dietrich has shown, *Pithecanthropus*, the Trinil race of Java, is not an ancestral Pliocene type, as was formerly supposed, but a surviving mid-Pleistocene branch, the companion of a stegodont elephant; the Trinil brain is a case of arrested development.

The conclusion is inevitable that *the main cubic evolution of the human brain took place during antecedent Tertiary time and not, as we formerly thought, during the Quaternary Age of Man or Glacial period.*

These six points are supported by the following comparison:

	Brain cube in cc
Summit of Quaternary and *Modern* time:	
Homo sapiens, Cro-Magnon of Mentone	1550
Palaeanthropus, Neanderthal Caveman, La Chapelle-aux-Saints	1530
Homo sapiens, average modern Swiss	1467
" " average modern European	1450
" " Alpine race of Czechoslovakia	1415
Homo sapiens, fossil Alpine race of Ofnet	1400
Homo sapiens, native Australian race	1310
" " native Indian Veddahs	1250
Mid-Quaternary:	
Pithecanthropus erectus (Trinil man of Java)	940
Summit of Tertiary:	
Eoanthropus dawsoni (Piltdown Dawn Man)	1240
Living Papuans of New Guinea	1236

It is well known that the *brain cube* is not a reliable test of brain power or capacity, as Leboucq has recently pointed out in striking examples from recent times:

	Brain weight in grams
Tourgenieff, Russian novelist	2,012
Cuvier, founder of paleontology	1,829
Byron, poet	1,807
Gambetta, statesman	1,246
Anatole France, littérateur	1,017 (to 1,317)

Doubtless this *cube-versus-intelligence* disparity in brain function also prevailed during the Quaternary Age of Man, although in the few fossil cases where comparison is possible we note a similar disparity between male and female brain weight.

We must therefore adduce collateral and very substantial proof that Upper Tertiary man, whom we may provisionally designate "the dawn man" after Smith Woodward's well-chosen term *Eoanthropus*, made highly intelligent use of his 1,240–1,300 cubic brain measurement.

This brings us to the most startling discovery of the twentieth century, the full significance of which we have only recently learned to estimate.

The First Positive Discoveries of Tertiary Man

Archeologists are still divided as to the human origin of *eoliths*, so that we can not class these rude flints as positive evidence.

One of the most striking coincidences in the history of human paleontology is that indubitable flint implements of Tertiary men were discovered by J. Reid Moir on the east coast of Anglia in the year 1909 and that in 1911, only two years later, an indubitable human skull and jaw of what proves to be Tertiary man were found in Piltdown, Sussex, by Charles Dawson. It has required eighteen years of research by Moir and Smith Woodward, aided by the most able archeologists and anatomists of the world, to establish the full significance of these epoch-making discoveries of 1909–11. By adding year by year implement after implement from two strata of Upper Pliocene time, J. Reid Moir, originally an amateur collector of Ipswich, has finally overcome all incredulity and even hostility and has thoroughly established the Red Crag and sub-Red Crag strata of the Upper Pliocene coast of Anglia as the site of a widespread and highly varied flint and bone industry, including the "eagle's beak" (rostro-carinate), "skin cutter," "side scrapper," "push plane," "borer" and "chopper" and "piercing tool," all indicating a race of hunters highly adept at flint flaking; finally, for killing purposes, a perfected "sling-stone," ranking as a work of Paleolithic art. All these artifacts have been confirmed and recently embodied in the Stone Age chronology of Abbé Henri Breuil (December, 1929). Breuil not only accepts the Tertiary age, but in his latest paper (December, 1929) shifts the entire pre-Chellean and Chellean flint industries from mid-Quaternary down into the base of Quaternary time, namely, into the first Interglacial or Mindel-Riss stage; this obviously shifts the pre-Chellean and Chellean flint-making design and intelligence down close to Tertiary time—in fact, some of Reid Moir's flints are identical with the Chellean artifacts.

Meanwhile Osborn, by world-wide study of fossil elephants and mastodonts, has firmly established these Reid Moir flint beds as of Upper Pliocene or close of Tertiary time, against the contention of the late Ray Lankester that these flints were early Pleistocene. Hardly less positive is Osborn's determination, with the aid of Reid Moir, Freudenberg, of Heidelberg, Matsumoto, and Bather and Hopwood, of the British Museum, that the Piltdown race—*Eoanthropus dawsoni* of Smith Woodward—is of Upper Pliocene Tertiary age rather than of Quaternary age as formerly supposed.

Both the Red Crag of Suffolk and the Piltdown beds of Sussex yield a very primitive species of elephant generally known as *Elephas planifrons* (first discovered, 1858, by Falconer in the upper Siwaliks of India), whose migrations are now traced from the Vaal River of South Africa (Broom) northward into Italy and England, far eastward into India, with absolutely definite measurement and form of the enameled ridge-plates of the grinding teeth which in the elephants and mammoths give us *a new and quite dependable means of dating all the fossil man discoveries of Upper Tertiary to Recent time.* Upper Tertiary man is thereby shown to have been an elephant hunter, probably for bone and ivory as well as for flesh, over a million years ago. This discovery also paves the way for the great intercontinental migration routes and the African-Eurasian dispersal of man even in as remote a period as the Upper Pliocene.

In view of the fact now established that even in the Upper Pliocene man was an extremely adept flint worker, with deft hands and fingers guided by an imaginative and intelligent forebrain, it seems probable that Upper Pliocene man, like his companion the Upper Pliocene elephant, was already a nomad and needed long and agile lower limbs as his only means of distant transportation. We are thereby forced to reconsider Darwin's concept of the primitive ape-man as inhabiting a "warm, forest-clad land."

Traveling Limbs and Tool-making Hands of Tertiary Man

Fifty-eight years of incessant zoological and comparative anatomical research have been focused upon

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the anatomy and embryology of the apes and man to find out the bearing of the recapitulation or biogenetic principle of Haeckel on the ancestral Tertiary hands and feet of man. Recently Morton (1927), Schultze (1925–29), Straus (1927), Gregory (1925–29), Hrdlička (1928), have devoted special memoirs to this problem, Straus summing up in the paraphrased words: The foot of embryonic man is of a structure unfitted for an upright terrestrial existence. It is in most characters not unlike that of an adult gorilla, although in some respects even more primitive than that of the largest anthropoid apes. The chief point of embryonic resemblance is in what Darwin termed "the prehensile big toe," but the paleontologist Matthew (1928) has pointed out that all primitive Eocene mammals, both arboreal and terrestrial, had the big toe well set apart from the others. This stronghold of "prehensile big toe" evidence, therefore, carries man far back of the highly specialized anthropoid ape big-toe stage and tends to sustain the "dawn man" contention that even the embryonic foot of man may date back to the more remote Upper Eocene time.

This contention is even more strongly borne out by the embryonic human hand, in which there is no evidence whatever of having passed through an anthropoid ape limb-grasping stage. While the newest analysis of the embryonic hind limbs may leave us in doubt as to a possible case of reversed evolution from the Miocene ape leg to the human stage, the human hand and the human brain, especially in the light of *Eoanthropus* discoveries, seem to dissipate some of the doubts raised by the feet and strengthen the new "dawn man" hypothesis of a very remote separation of our running and tool-making ancestors of the plateaus and savannas from the same great stock (Anthropoidea) which independently gave rise to the tree-loving anthropoids of the tropics.

No one should misunderstand the "dawn man" hypothesis I have been advocating in a series of papers and addresses since April 7, 1927. I am not ignoring the strong evidence for an Eocene arboreal stage in our ancestry; I am not ignoring the overwhelming evidence of a remote community origin between man and the anthropoid apes; I am combating the special feature of the Lamarck-Darwin hypothesis that man once passed into highly specialized arboreal adaptations attained by the Miocene apes; finally, I am inclined to separate the human stock at a geologically earlier pre-Miocene period of anthropoid evolution. In the geologic remoteness of this momentous separation of the "dawn man" stock we are aided by a mass of collateral evidence utterly unknown in the time of Darwin.

This brings us back to the sub-science of phylogeny spoken of above, which, in popular terms, aims at the reconstruction of the family tree of man by principles recently discovered in the family trees of other mammals.

NEW PRINCIPLES OF PHYLOGENY APPLIED TO MAN

First, we have discovered that the geologic period of separation of the adaptively radiating branches in many families of mammals is of an antiquity undreamt of even a few decades ago. Even in Lower Eocene time all the existing families of hoofed mammals, such as the horses, tapirs, rhinoceroses and titanotheres, had widely separated from each other in tooth, limb, hand and foot structure. Before the close of Eocene time these branches were further subdivided into forest-loving and plateau-loving types; in every branch the forest-loving types were stationary or regressive. Similarly, by the close of Eocene time the mastodont and elephant families are found widely separated into five greater branches (in Oligocene time there were numerous sub-branches and in Miocene time eighteen distinct branches). In the succeeding Oligocene time we discover a sharp and world-wide division between plateau-loving and forest-loving types: in the forests remain all the backward conservative types; on the plateaus and uplands are found the alert, progressive, forward-looking types, including all the long-hind-limbed bipedal animals adapted to rapid progression in an open or partly forested country. It is no exaggeration to say that at the dawn of Oligocene time all the plateau-loving animals are distinctly modernized both in habits and in bodily proportions.

Is it likely that the primates alone escaped this divorce between backward, forest-loving life and forward, plateau, savanna and upland life, especially as Eocene forest areas in every continent began to contract and upland open plains and plateaus began to expand?

A second principle of modern phylogeny is that every ancestral stage, whether of horse, rhinoceros or elephant (the three kinds of animals I have most intensively studied for the past thirty years), preserves the hundred per cent. *structural equipment* for giving rise to its more recent or modernized descendants; each branch has the potentiality of the remotest twigs of descent. Through change of function nature may transform an organ but it can never restore a single lost part, whether it be a lost tooth, a lost digit, a lost ankle bone or rib, a lost tendon or nerve. This is Dollo's principle that *the evolution of anatomical organs is never reversible even though the evolution of functions and habits is frequently reversible.* On this principle the human hand could never reacquire the nerves, muscles, functions, freedom, flexibility and separate innervation lost in the

highly specialized arboreal ape hand; the opposable human thumb could not spring back from the partly atrophied anthropoid ape thumb. Our quadrupedal ancestors certainly had a forefoot capable of developing into the human hand with its long flexible fingers separately innervated and its thumb which, as Erasmus Darwin postulated, could reach the tip of each finger in turn, all depending upon separate innervation from special cell centers in the spinal cord and brain. Primitive man is not only a tool-making animal, he is a music-making animal; consider "Blind Tom," the negro musical genius of his day, who not only possessed an excellent finger technique but a marvelous musical memory that enabled him after a single hearing to repeat elaborate piano compositions. In this human hand connection let us recall also the researches of Sir Richard Paget in advocating the gesture origin of human speech, as gesture demands flexible fingers.

Third, to this hundred per cent. structural equipment of our remote ancestors phylogeny adds a hitherto unperceived germinal potentiality of specialization along certain pre-determined directions rather than others in adaptive reactions to changes of environment; this *teleogenesis* rests upon thousands of observations among primates, horses, titanotheres and elephants which prove that parallel anatomical and psychical progress is traceable to germinal community of origin. The psychic resemblances of the apes to man are partly parallelisms, partly common inheritance (Yerkes). Teleogenesis is not to be confused with the old "teleology," nor is it a revival of a hypothetical vitalism or internal perfecting tendency.

Finally, and perhaps from glandular impulses (Keith), phylogeny proves that independent of selection, of environment, of habit, certain phyla exhibit rapid or accelerated physical and mental adaptation, while others are held back. The creative brain, the tool-making hand, the fleet hind limb of man apparently combine in accelerated adaptation, while forest-loving primates advance much more slowly.

Does not this unbiased survey of recent discoveries in archeology, human and comparative paleontology and human and comparative anatomy, compel us to reconsider the classic Darwin-Lamarck hypothesis and to substitute a new hypothesis? The new hypothesis carries us into a geologic antiquity hitherto undreamt of. Anthropology is forced to share with chemistry and physics entirely new notions of space and time. To my mind the human brain is the most marvelous and mysterious object in the whole universe and no geologic period seems too long to allow for its natural evolution.

OBITUARY

KARL VON DEN STEINEN

THROUGH the sudden death of Karl von den Steinen, which occurred on the fourth of November, 1929, anthropology has lost one of its most eminent representatives.

Born in 1855 at Mühlheim a./d. Ruhr, he attended the Gymnasium of Düsseldorf, from which he graduated in 1871. He studied medicine at the Universities of Zurich, Bonn and Strassburg, devoting himself particularly to psychiatry. He was assistant at the Charité in Berlin, but soon he gave up this position and took a journey around the world which lasted from 1879 to 1881. On this journey he met Adolf Bastian in Hawaii and accompanied him on his visits to the natives. Bastian's enthusiasm for ethnological problems, the varied experiences of the long journey and contact with many foreign cultures were probably the causes that determined von den Steinen's ever-increasing devotion to the problems of anthropology.

At that time, however, geographical problems were nearer to his mind. In 1882 he was a member of the German party in charge of the meteorological station in South Georgia—one of the series of stations that were to observe for a year the meteorological and magnetic conditions in both circumpolar regions. Later on he published his observations, made during this year, on the life of the seals and birds of South Georgia. Immediately upon his return in 1884 he organized an expedition through Central Brazil and explored the Xingú, one of the southern tributaries of the Amazon, which up to that time was entirely unknown. This journey yielded important geographical results and at the same time brought him into close contact with the primitive natives of this area who were at that time still almost entirely untouched by European civilization. His account "Durch Zentral Brasilien" gave the results of his observations. Not satisfied with the completeness of his studies, he returned to Brazil in 1887 and devoted himself entirely to the study of the natives of the Xingú region. For several years after his return he was occupied with work on the results of this expedition which was finally published in 1894 under the title, "Unter den Naturvölkern Zentral Brasiliens," a book which has become one of the classics of ethnological literature. He published his linguistic observations in 1892 as a grammar of the Bakairí language.

Meanwhile he had accepted a chair at the Univer-

sity of Marburg where he taught for two years, 1891 and 1892. At the same time he was editor of the *Ausland*, an old, well-established journal that contained particularly ethnological and geographical information. The duties of these positions were not congenial to him because they absorbed too much of the time that he wished to devote to research, and soon he returned to Berlin where, in 1896, he was elected president of the Berlin Geographical Society.

His interest in the problems of the Pacific Ocean never flagged. In 1897 he went to the Marquesas Islands. He visited every island and every village and amassed most valuable ethnological material. On his return journey in 1898 he visited some of the northwestern tribes of Canada. Then followed years of unremitting study. He was never satisfied with the mere collection of material but saw in it a means of solving problems. Ever since his Brazilian journey the question of primitive art was uppermost in his mind, and the interpretation of the curious and intricate forms of Marquesan art was one of the attractions that this remote group of islands held out to him. With indefatigable persistence he visited all the museums of Europe and America and accumulated material for the study of the historic development of Marquesan art during the period of our knowledge of the islands. His purpose was the attempt to reconstruct the earlier history of this art. Work on this particular problem was interrupted by the duties which he undertook as director of the South American department of the Ethnological Museum of Berlin, a position which he occupied from 1902 to 1906. Again he found that administrative duties made too heavy demands on his time and he returned to the problems that interested him most profoundly.

During this period he took a most active part in the scientific life of Berlin. From 1908 to 1910 he was president of the Berlin Anthropological Society, and his house was the center to which all interested in ethnological studies resorted. It is largely due to his influence that Germany has taken a prominent part in anthropological work in South America. Paul Ehrenreich, Max Schmidt and Theodor Koch-Grünberg were all stimulated by his enthusiasm.

It is fortunate that it was given to him to see published his great work on the art of the Marquesans. The first volume appeared in 1925, the second and third volumes in 1928. In his book on Brazil he had taken the view that all geometrical art developed through conventionalization of realistic forms. In later years he abandoned this view, and the value of his great Marquesan work lies in the attempt to interpret on the basis of painstaking formal analysis the many directions art forms take under the conditions of technique and of constant reinterpretation. The wealth of material and the penetrating analysis of forms are such that now, since the book has been in our hands only a short time, it is quite impossible to assess fully its value, but there can be no doubt that his method of examination sets a new standard for all studies of similar subjects, not only in art but equally in religion, ceremonial life, social structure and invention. We deeply regret that it was not given to him to work out by similar methods the large mass of traditional literature that he collected. His Marquesan work stands out as an example of thoroughness and of critical acumen.

In his younger years von den Steinen, because of his wide knowledge and his rare social gifts, exerted a wide influence, but as he grew older he retired more and more to his study. His counsel was sought but he did not take an active part in scientific affairs. His personal charm and his loyalty endeared him to all who had the privilege of knowing him intimately, and his friends mourn his death no less as a personal loss than as a loss to science.

FRANZ BOAS

COLUMBIA UNIVERSITY

RECENT DEATHS

PROFESSOR RALPH H. CURTISS, professor of astronomy and director of observatories at the University of Michigan since 1927, died on December 25 in his fiftieth year.

A CORRESPONDENT writes that Emile Francis Williams, a charter member of the New England Botanical Club and from 1896 to 1917 its recording secretary and treasurer, died at his home in Cambridge, Massachusetts, on December 19, in his seventy-second year. He was born in Boston on January 11, 1859, and spent his early youth in France, where he received his early education in Paris. Returning to America he continued his studies at the Massachusetts Institute of Technology, from which he was graduated from the civil engineering course in 1878. For many years he engaged in business as an importer of rugs and other oriental goods of rarity, devoting, however, much of his time to the pursuit of botany. He made frequent visits to the less explored portions of New England and the adjacent parts of the Maritime Provinces. He had exceptional skill in the selection and preparation of plant-specimens and built up a personal herbarium of unusual excellence. This, including about 14,000 sheets of mounted specimens, he gave to the Gray Herbarium of Harvard University, of which he had, for many years, been a highly valued member of the visiting committee. He was one of the founders of the New England Botanical Club and during more than twenty years devoted much care to its exploring activities, the upbuilding of its col-

lections, a very methodical record of its meetings and an effective oversight of its finances. After his retirement from business he traveled much in southern central France and brought out his experiences in a work called "Undiscovered France," a beautifully illustrated volume of unusual insight and charm.

SCIENTIFIC EVENTS

SITE FOR A NEW OBSERVATORY AT THE UNIVERSITY OF MICHIGAN

THE University of Michigan has acquired by purchase two hundred acres of land lying along the left bank of the Huron River, which will be used as a site for a new astronomical observatory. The site had the approval of the late Professor Ralph H. Curtiss, director of astronomical observatories, and was also approved by the late Professor William J. Hussey. It includes, according to an account in *The Michigan Alumni*, a commanding elevation close to but not on a main highway, and is entirely removed from the smoke, vibration, city lights and other conditions which have in recent years continued in increasing degree to make modern astronomical study impossible in the present observatory.

Architects' plans have already been drawn for an observatory designed to accommodate a 75-inch telescope and all the other apparatus required in modern astronomical investigations. The building, according to the plans, will be unpretentious but substantial and fireproof. Aside from the telescope building, the university plans to build a residence for the keeper and the observing staff, and estimates that the cost of the entire undertaking will be $260,000.

Seventy-five years ago the present observatory was built and equipped with what was then one of the best obtainable telescopes. At that time it was located on the edge of town, where the air was clear, and there were no buildings near by. Since that time it has been hemmed in upon all sides, the view of the skies is obscured by smoke from the university powerhouse, and the operation of the delicate instruments is made nearly impossible by the continual jars caused by the heavy traffic on Ann and Observatory Streets. It is impossible to carry on research work under these conditions. The telescope, which was one of the finest in the country at the time of its purchase many years ago, is now outdistanced by the modern instruments at Harvard, Mt. Wilson, Ohio Wesleyan and Victoria, B. C., and its field is said to be practically worked out.

If the observatory is moved, the university will come into possession of thirty-two acres of land inside the limits of Ann Arbor, which will be free from all restrictions. Four of these acres are used as the site of the present observatory. This property was purchased in 1354 by a fund to which the Honorable Henry N. Walker, Senator Zachariah Chandler, General Lewis Cass and Governor Henry P. Baldwin contributed. There are twenty-six acres of ground east of Observatory Avenue, adjoining the Hospital grounds, which Robert P. Lamont has held for some time for the use of the observatory, as well as two additional acres on which the university has been allowed to erect buildings, with the understanding that other provisions would be made to meet the needs of the observatory. If the observatory is moved, this land will be deeded to the university.

THE INTERNATIONAL CONGRESS OF SOIL SCIENCE

IN accordance with the decision of the general committee of the International Congress of Soil Science meeting on July 6 in Budapest, the sessions of the second congress will be held in Leningrad from July 20 to 31, 1930, under the presidency of C. C. Gedroiz. The first six days the meetings will be in Leningrad and the remaining time will be spent in Moscow. In both cities a series of excursions will be arranged and exhibits of general soil science including special displays devoted to agronomical and forest soil science, utilization of marshes, technical processes of cultivation, land taxation, etc.

After the congress an excursion of twenty-nine days will be made across the soil zones of the European part of Soviet Russia, during which the members will have the opportunity of visiting higher schools, agricultural experiment stations, agricultural and industrial enterprises, etc.

The excursion will be made by special railway trains supplied with sleeping-cars and dining cars, and by steamer on the Volga and the Black Sea. Out of the twenty-nine excursion days three days will be given for rest, two in the Caucasus and one in the Ukraine. In addition to this excursion, special excursions may, if desired, be arranged: (1) to the Mourman peninsula for visiting peat-soils, forest swamps, the biological station, the railroad colonization, etc.; (2) to central Asia, and (3) to the agricultural exhibit of Minsk (White Russia) and other places. A discount of 50 per cent. is given on the railway fares. Members desiring to attend both congress and excursions are requested to communicate with Professor Dr. A. Yarilov, president of the Organizing Committee, Moscow, Karuninskaja, Gosplan, not later than February 1, stating at the same time the town in which they would like to receive the visa to enter Russia.

The organizing committee undertakes to secure the visas required for entering and leaving Russia and to provide on request, rooms, food and vehicles for the entire period of the congress and excursions. Towards these expenses the members of the general committee of the International Society of Soil Science and members who have some special share in the work of the society will pay on their arrival at Leningrad $300 to the organizing committee. All other members who have paid their yearly subscriptions up to January 1 will pay $350, while those who have joined after January 1 will pay $450. The expenses of those who do not participate in the excursions will be $110. Those wishing to accompany the excursion only as far as Stalingrad on the Volga can leave the party conveniently at the point. The prices of railway tickets are quoted to Leningrad as follows: From Berlin via Warsaw-Negoreloie: 2nd class $32; 3rd class $22; from Warsaw: 2nd class $22; 3rd class $13; from Riga: 2nd class $12; 3rd class $8; from Stockholm via Abo: 2nd class $16; 3rd class $9; entrance and departure visas (both) $5.50.

THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE Australasian Association for the Advancement of Science will hold its twentieth meeting at Brisbane during the week beginning on May 28, 1930. The president-elect of the association is E. C. Andrews, government geologist, Sydney, and the vice-presidents are Professor Sir T. W. Edgeworth David, emeritus professor of geology in the University of Sydney (president, Dunedin meeting, 1904, and Melbourne meeting, 1913); Professor Sir David Orme Masson, emeritus professor of chemistry in the University of Melbourne (president, Sydney meeting, 1911); Professor Sir W. Baldwin Spencer, emeritus professor of biology in the University of Melbourne, director of the National Museum, Melbourne (president, Hobart-Melbourne meeting, 1921), and Lieutenant-General Sir John Monash, chairman, State Electricity Commission of Victoria (president of the Adelaide meeting, 1924).

The association meets in sixteen sections, each presided over by a president and several vice-presidents. The sections and their presidents are as follows:

Section A—Astronomy, Mathematics and Physics. President, J. M. Baldwin, Observatory, Melbourne.

Section B—Chemistry. President, Professor E. J. Hartung, The University, Melbourne.

Section C—Geology. President, E. de Courcy Clarke, The University, Perth.

Section D—Zoology. President, R. J. Tillyard, Commonwealth Entomologist, Canberra.

Section E—History. President, Professor J. R. Elder, University of Otago, New Zealand.

Section F—Anthropology. President, Professor A. R. Radcliffe-Brown, The University, Sydney.

Section G—Social and Economic Science and Statistics. President, D. T. Sawkins, Bureau of Statistics, Young Street, Sydney.

Section H—Engineering and Architecture. President, Professor Leslie Wilkinson, The University, Sydney.

Section I—Medical Science and National Health. President (to be announced).

Section J—Education, Psychology and Philosophy. President (to be announced).

Section K—Agriculture and Forestry. President, W. N. Jolly, Forestry Commission, Sydney.

Section L—Veterinary Science. President (to be announced).

Section M—Botany. President, H. H. Allan, Plant Research Station, Palmerston North, New Zealand.

Section N—Physiology and Experimental Biology. President, Professor T. Brailsford Robertson, The University, Adelaide.

Section O—Pharmaceutical Science. President, A. B. Chater, Care of Taylors and Elliotts, Valley, Brisbane.

Section P—Geography. President, Dr. C. Fenner, Adelaide.

POPULAR SCIENCE MONTHLY PRIZE AWARD

Popular Science Monthly announces that, beginning this autumn, it will confer an annual prize of $10,000, accompanied by a gold medal, upon the American citizen who has been responsible, during the preceding year, for the achievement in science of greatest potential value to the world.

In making this announcement, O. B. Capen, president of the Popular Science Publishing Company, explained that the award was instituted with a dual purpose—to heighten the interest of the American people in those conquests of the laboratory and the workshop which benefit the entire community, and to focus attention upon the many scientific workers who, without thought of personal profit, toil to better man's control over his physical surroundings.

The award will be bestowed under the auspices of the Popular Science Institute, a research organization maintained by the magazine, of which Professor Collins P. Bliss, associate dean, New York University, is director. The institute has enlisted the services of twenty-four leaders in American science to serve as a committee of award, whose task it will be to select the prize-winning effort.

The prize will be conferred for the first time in September, 1930, and the initial period of scientific accomplishment to be considered by the Committee of

Award will be the twelve months ending June 30, 1930. All scientific workers, professional and amateur, academic and commercial, are eligible.

The members of the Committee of Award are:

Dr. Charles G. Abbot, secretary, Smithsonian Institution; Professor Collins P. Bliss, director, Popular Science Institute; Dr. Samuel A. Brown, dean, New York University and Bellevue Hospital Medical College; Dr. George K. Burgess, director, United States Bureau of Standards; Dr. William W. Campbell, president, University of California; Dr. Harvey N. Davis, president, Stevens Institute of Technology; Dr. Arthur L. Day, director, Geophysical Laboratory, Carnegie Institution; Dr. E. E. Free, consulting engineer; Travis Hoke, editor, *Popular Science Monthly;* Dr. Frank B. Jewett, vice-president, American Telephone and Telegraph Co.; Dr. Vernon Kellogg, permanent secretary, National Research Council; Charles F. Kettering, president, General Motors Research Corporation; Dr. Arthur D. Little, president, Arthur D. Little, Inc.; Dr. John C. Merriam, president, Carnegie Institution; Dr. Robert A. Millikan, chairman, executive council, California Institute of Technology; Dr. Henry Fairfield Osborn, president, American Museum of Natural History; Dr. Elmer A. Sperry, chairman, board of directors, Sperry Gyroscope Co.; Dr. Samuel W. Stratton, president, Massachusetts Institute of Technology; Dr. Elihu Thomson, director, Thomson Laboratory of the General Electric Co., Lynn, Mass.; Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research; Henry Herman Westinghouse, chairman, board of directors, Westinghouse Airbrake Co.; Dr. Albert E. White, director department of engineering research, University of Michigan; Dr. Willis R. Whitney, director of research, General Electric Co., Schenectady, N. Y., and Orville Wright, co-inventor of the airplane.

SCIENTIFIC NOTES AND NEWS

DR. THOMAS HUNT MORGAN, director of the Kerckhoff Laboratories of the Biological Sciences of the California Institute of Technology, Pasadena, was elected president of the American Association for the Advancement of Science at the close of the Des Moines meeting.

AT the 158th convocation of the University of Chicago, the degree of doctor of science was conferred on three chemists—Professor Moses Gomberg, Professor Gilbert Newton Lewis and Dr. H. A. Spoehr. The candidates were presented by Henry Gordon Gale, dean of the Ogden Graduate School of Science. The citations were as follows: Moses Gomberg, head of the department of chemistry, University of Michigan, "in recognition of his fundamental contributions to chemistry, especially in the discovery of free radicals, and in testimony of his leadership in the field of organic chemistry." Gilbert Newton Lewis, head of the department of chemistry, University of California, "in recognition of fundamental contributions to chemistry, especially in atomic and molecular structure, and in thermodynamics, and in testimony of his leadership in research in physical chemistry." Herman Augustus Spoehr, who received a Ph.D. degree from Chicago, and is now assistant director of the Coastal Laboratory of the Carnegie Institution of Washington, "in recognition of his fundamental contributions in the field of photosynthesis and in testimony of his leadership in the application of chemistry to botanical problems."

THE Edison medal, awarded by the American Institute of Electrical Engineers for "meritorious achievement in electrical science, electrical engineering or the electrical arts" has been conferred on Dr. Charles F. Scott, professor of electrical engineering at Yale University, for "his contributions to the science and art of polyphase transmission of electrical energy."

THE David Livingstone Centenary medal has been awarded by the National Geographic Society to Commander Richard E. Byrd. The Hispanic Society of America founded the decoration in 1913 with the proviso that it could be given only for "exceptionally important achievement in the field of geography of the Southern Hemisphere." Others who have received the medal include Sir Douglas Mawson, leader of the Australian-Antarctic expedition of 1911–1914; Theodore Roosevelt, for his discovery and exploration of the "River of Doubt," now known as Rio Roosevelt, and Colonel Rondon, for exploration of the Brazilian interior.

A RECEPTION and dinner dance was given to W. W. Skinner, assistant chief, chemical and technological research, U. S. Department of Agriculture, on December 4 to commemorate the completion of twenty-five years' service. On this occasion a silver token was presented to him by Dr. A. F. Woods, who spoke in appreciation of Dr. Skinner's work for the department. Dr. F. B. Linton presided at the dinner as toastmaster. The speakers were Dr. H. G. Knight, chief of the bureau of chemistry, who spoke of Dr. Skinner as a scientific man and administrator, and Mrs. M. T. Read, who spoke on Dr. Skinner as a man.

PROFESSOR WILLIAM MCPHERSON, dean of the Graduate School of the Ohio State University, became president of the American Chemical Society on January 1 as a result of the society's annual election.

Dr. McPherson will serve during 1930, succeeding Dr. Irving Langmuir, associate director of research of the General Electric Company. Dr. Moses Gomberg, professor of chemistry in the University of Michigan, was chosen president for 1931. In accordance with a recent change in its constitution, the society now elects each year a president and a president-elect, who serve in successive years. Professor James F. Norris, of the Massachusetts Institute of Technology, and Charles L. Reese, of the E. I. du Pont de Nemours and Company, Wilmington, Delaware, were elected directors for 1930–1932. The following are councillors-at-large: Edward Bartow, professor of chemistry, Iowa State University; Professor S. C. Lind, director of the School of Chemistry, University of Minnesota; Dr. Hugh S. Taylor, professor of physical chemistry, Princeton University, and David Wesson, consulting chemist, of Montclair, New Jersey.

AT the thirty-sixth annual meeting of the American Mathematical Society, which opened at Lehigh University on December 26, Professor E. R. Hedrick was reelected president. The vice-presidents are Professor W. C. Graustein, of Harvard University, and Professor E. P. Lane, of the University of Chicago. The meeting next summer will be held at Brown University. The winter meeting will be held at Western Reserve University and the Case School of Applied Science. In the summer of 1931 the society will meet at the University of Minnesota.

DR. FREDERICK C. WAITE, professor of histology and embryology at Western Reserve University, has been elected president of the Ohio Academy of Science for the year 1929–30.

PRINCETON UNIVERSITY announces the appointment of Dr. J. von Neumann, of the University of Berlin, and Dr. E. Wigner, of the Kaiser Wilhelm Institut für Physikalische Chemie, as visiting lecturers in mathematical physics for the second term of the present academic year. Dr. von Neumann and Dr. Wigner have both contributed to the development of modern mathematical physics, particularly in the theories of relativity and quantum mechanics, and during the past few years have collaborated in applying these principles to problems of molecular structure.

DR. KO KUEI CHEN, known for his work on ephedrine, has become director of pharmacologic research of Eli Lilly and Company, Indianapolis.

PER K. FRÖLICH has resigned his position as associate professor in chemical engineering and assistant director of the Research Laboratory of Applied Chemistry at the Massachusetts Institute of Technology, to join the staff of the Standard Oil Development Company, Elizabeth, N. J., where he will work on special research problems on petroleum.

PROFESSOR ALFRED C. LANE, of Tufts College, and Professor Albert P. Brigham, of Colgate University, have been added to the staff of consultants of the Library of Congress.

DR. T. WAYLAND VAUGHAN, director of the Scripps Institution of Oceanography at La Jolla, has been appointed to represent oceanography on the general subcommittee for geology of the Science Advisory Committee for the Chicago World's Fair of 1933.

VICENTE G. LAVA, associate professor of physical chemistry at the University of the Philippines, who has leave of absence, is visiting professor and Grasselli Research fellow at Oberlin College, working in colloid chemistry under Harry N. Holmes.

C. P. BULLER has been appointed first senior observer in the solar physics observatory of the University of Cambridge.

MR. AND MRS. ROBERT T. HATT, of the American Museum of Natural History, have returned from a three months' expedition to Yucatan, where they collected recent mammals and reptiles and excavated fossils in the caves occurring in Yucatan's low mountains.

AT the annual meeting of the American Society of Mechanical Engineers, Dr. Fred R. Low, editor of *Power;* Robert LeRoy Streeter, vice-president of the U. S. Aluminium Company; Harold W. Mowery, safety engineer with the American Abrasive Metals Company, and Edward J. Kearney, secretary and treasurer of the Kearney Trecker Company, were elected chairmen of the four standing technical committees, Power Test Codes, Research, Safety and Standardization, respectively.

A CONFERENCE committee convened on December 12 and December 13, at the Missouri Botanical Garden, for the purpose of discussing methods for making cultures of wood-destroying organisms and specifically to discuss methods for determining toxicity relations of poisonous substances to wood-destroying fungi and type of conclusions which could be drawn after making toxicity determinations. The following were in attendance: Dr. Henry Schmitz, of the University of Minnesota; Mr. J. D. Burnes, of Page and Hill; Mr. Ernest Bateman, senior chemist of the United States Forest Products Laboratory; Dr. Carl Hartley, principal pathologist, and Dr. C. Audrey Richards, pathologist, U. S. Bureau of Plant Industry; Dr. R. H. Colley and Mr. R. E. Waterman, of the Bell Telephone Laboratories; Mr. C. S. Reeve, of the Barrett Company; Mr. S. R. Church, consulting engineer; Mr. E. B. Fulks, vice-president of the American Creosoting Company; Dr. A. L. Kammerer, consulting timber engineer, St. Louis; Dr. David H. Linder, mycologist, and Dr. Hermann von Schrenk, pathologist, Missouri Botanical Garden, St. Louis.

THE ninth series of Beaumont lectures of the Wayne County Medical Society, Detroit, will be given on January 27 and 28 by Dr. Wingate Todd, professor of anatomy in the Western Reserve University School of Medicine.

DR. CLARENCE E. MCCLUNG, professor of zoology and director of the zoological laboratory, University of Pennsylvania, will read a paper on "A Working Model of a Modern University" before the American Philosophical Society, Philadelphia, on January 3.

DR. H. H. WHETZEL, head of the department of plant pathology at Cornell University, addressed the instructional staff of the school of agriculture at the Pennsylvania State College on December 17.

DR. N. E. FORSYTHE, of the Nela Park Laboratories of the General Electric Company at Cleveland, Ohio, addressed the Physics Club of Philadelphia on December 13 on the "Physical Production of Ultra-violet Light."

PROFESSOR GARY N. CALKINS spoke before the New York Biology Teachers Association on December 20. He took for his subject "The Nucleus."

DR. C. M. YONGE, director of the Great Barrier Reef Expedition to Australia, recently gave a popular illustrated lecture on the work of the expedition before the Rutgers chapter of Sigma Xi at New Brunswick and before the Biological Seminar of Princeton University.

ON December 14, Dr. A. P. Coleman, professor emeritus of geology at the University of Toronto, delivered a lecture to the Royal Canadian Institute, on the subject, "The Last Million Years."

SIR RICHARD GREGORY, editor of *Nature*, gave an address on "Science and the Empire" at a joint meeting of the Royal Empire Society and the British Association for the Advancement of Science held at the Hotel Victoria on December 3. A brief address was also made by Sir Thomas Holland, president of the British Association.

THE American Association of Petroleum Geologists will hold their fifteenth annual meeting at New Orleans on March 20, 21 and 22, under the presidency of J. Y. Snyder, of Shreveport, Louisiana.

ON January 10 the first Chilean Congress of Pathology will meet in Concepcion with more than 600 delegates in attendance. An exposition of medical and sanitary products, technical books and publications will be held in conjunction with the congress.

A SPECIAL correspondent of the New York *Herald Tribune* reports that closer relations between the United States Department of Public Health and the Mexican Department of Health will be sought at the seventh Latin-American Medical Congress, to be held in Mexico City from January 12 to 19. Dr. Hugh S. Cumming, of the United States Department of Public Health, is expected to attend. Argentina, Peru, Brazil, Chile, Cuba and San Salvador will send delegates, and all other Spanish-American countries are expected to be represented. The congress in January will be the first held since 1922 in Latin-America. It is expected that President Emilio Portes Gil, of Mexico, will open the convention. In conjunction with the congress the second National Hygiene Convention of Mexico will be held. Also there will be a scientific exposition, in which the School of Medicine of the University of Mexico, the Federal Department of Health, the Public Charities and the Military Medical School will take part.

THE Commonwealth Fund has made an additional appropriation of $27,000 to continue a series of psychiatric fellowships at the psychopathic hospital at the University of Colorado School of Medicine, Denver. Six fellows are now in training. The new appropriation will make possible the appointment of three more in 1930 and three more in 1931 for periods of two years.

AN Institute of Paper Chemistry, a graduate school for the training of chemists in the pulp and paper industry, has been established at Lawrence College, Appleton, Wisconsin. The institute, which has been organized as an affiliated institution, has the support of ninety per cent. of the paper mills of Wisconsin and will be controlled by a board of trustees representing the college and the participating mills. President Henry M. Wriston is director of the new organization, Dr. Otto Kress, paper chemist, is technical director, and Ernest Mahler, vice-president of the Kimberley-Clark Paper Company, president of the board of trustees. Appropriations sufficient to meet an annual budget of at least $60,000 have been assured the college by the paper manufacturers. It is planned to open the institute in February, 1930. Two fellowships with annual stipends of $500 each have been endowed for the institute by the Paper Makers Chemical Corporation, manufacturing chemists. The fellowships, which will be available with the opening of the institute, are to be awarded to students showing suitable qualifications for the advanced work of the graduate school.

A SERIES of conferences for the purpose of helping freshmen in their choice of a major engineering course has been announced by Dean Paul Cloke, of the College of Technology of the University of Maine. The conferences will begin at once and extend through January and February. The following topics will be discussed in order: Engineering Studies, Experiences in Engineering, Chemical Engineering,

Civil Engineering, Electrical Engineering, Mechanical Engineering, Relation of Athletics to College Life, Student Life. The discussions will be led by the dean, the department heads and the faculty manager of athletics. Although designed for freshman engineering students, the conferences will be open to all who are interested, especially those who are having difficulty with their work.

UNIVERSITY AND EDUCATIONAL NOTES

AN anonymous gift of $100,000 to the University of California has been received for the support of research in cancer and allied subjects by the medical school and the Hooper Foundation for Medical Research. With the addition of this fund, the university will have a total endowment of $200,000 for research in this field. Mr. and Mrs. George H. Roos, of San Francisco, recently made a gift of $100,000 for research in thoracic surgery and cancer, and later added $5,000 for the equipment of a clinic and research laboratory to carry on this work.

THE late Abraham Rosenberg, San Francisco merchant, who was a leader in developing world markets for California dried fruits, has included in his will a bequest of $100,000 to the University of California as an endowment for the support of graduate research fellowships.

IN honor of Martin J. Insull, of Chicago, Mrs. Insull has founded and endowed with $25,000 a scholarship in the college of engineering of Cornell University, from which Mr. Insull was graduated with the degree of M.E. in 1893, and in which he is himself building up a loan fund for the benefit of students. The new scholarship may be held for four years and during that time will pay most of the scholar's expenses at college, amounting, at the present rate of tuition, to an average of more than $1,000 a year.

IT is announced that in accordance with the wish of Dr. Joseph S. Ames, who recently succeeded Dr. Frank J. Goodnow as president of the Johns Hopkins University, there will be no formal inauguration ceremonies.

THE resignation is announced of Arthur Edward Wells, professor of metallurgy at Harvard University.

DR. BENNO EDWARD LISCHER, of the University of Michigan, has been appointed full-time professor of orthodontics in the University of California.

DR. KENNETH GOODNER has been appointed instructor in bacteriology and immunology in the School of Public Health at Harvard University.

AT the University of Cambridge, C. F. A. Pantin, of Trinity and Christ's Colleges, has been appointed university lecturer in zoology, and J. E. E. Craster, of Downing College, has been appointed university lecturer in geography.

DISCUSSION

SUPERFLUOUS PUBLICATIONS

THERE appears to be an increasing tendency for the publication of journals devoted to exploitation of work by individual laboratories and organizations promoting an extended program of research on varied subjects. There are dozens of institutions where the amount of manuscript produced per year is amply sufficient to fill the pages of a weekly, monthly or quarterly journal so that a reasonable temptation on the part of the executives of these institutions may readily exist for the independent maintenance of an organ of publication. It is doubtful, however, if the publicity so secured reacts favorably toward the organization concerned.

Usually such a journal is a hopeless compilation of reports on almost every subject known to science. A short article on atomic physics may be buried between a memoir on the physical properties of concrete and a report on the design of an aeroplane propeller. For continuity, the Encyclopaedia Britannica is to be preferred.

A serious problem confronts the librarian in the cataloguing and disposition of these publications, especially in universities where reference libraries are divided and allocated to the various departmental offices. Institutions devoted to a restricted subject are forced to subscribe to a journal containing numerous articles on material of little interest in order to have on file a few papers of immediate importance. Often the smaller institutions will not subscribe to the journal and papers of importance to it are lost except through the courtesy of the particular authors in distributing reprints. The miscellaneous character of such journals is also responsible for inadequate review of their contents by the various abstract journals. Many papers so published have not been abstracted and accordingly are unknown in the bibliography of the particular subject concerned.

The research investigators in institutions maintaining private publications recognize the handicap to which they are subjected and desire to submit their reports to a medium of publication primarily concerned with papers of a similar character. If such a policy is permitted, however, the privately printed

journal either dies a natural death, as it should, or continues its existence as a collection of articles reprinted from the many technical journals devoted to specific subject-matter. As few executives will subscribe to the policy of the publication of a mere collection of reprints, since this is too obviously an extravagant procedure, it is usually necessary, for the very existence of the private journal, that the employees of the laboratory concerned be required to submit their papers to their own journal for prior publication. In general, society publications are at liberty to reprint such material, but their editors likewise feel that the extravagant policy of publishing the same article in two journals should not be encouraged. Most of the large society-controlled journals for this reason require that their editors accept no paper for publication which has appeared in any other medium.

The menace of the private journal has another far-reaching influence. Many societies already claim ownership to the written report of investigations presented before their stated meetings, and this policy can be and, with the continuance of private journals, must be more rigorously extended and enforced. The society journal is the center at which the activities of an organization concentrate. It is the duty of each member of a society to see that his particular journal is given every possible support. An institution which enforces prior publication in a private journal therefore acts contrary to the best interest of the national organization and in many cases prevents its personnel from playing an active rôle in the national and cooperative development of research. In this way the privately printed journal defeats the very purpose for which it is supposedly sustained. It fails to secure adequate publicity for its own work and its maintenance militates against the national recognition of its contributors who may be barred from participation in the national meetings and from honors which might otherwise be extended.

About the only excuse for a private journal is that it serves as a means for the publication of extended memoirs which would be rejected by society-controlled journals. Two reasons may occur for such a rejection. The paper may contain a large amount of superfluous material which could have been readily omitted in which case it might have been acceptable. Often a lengthy paper will be read by possibly ten or less interested individuals, and an abbreviated account of importance to a larger group of readers could be published in a recognized journal with a statement to the effect that mimeographed copies of the complete report with numerous data are on file for loan by the author's institution. On the other hand, it may rarely occur that the publication of an extended manuscript is highly desirable but because of the excessive cost funds are not available for its appearance in a society journal. The work might then well appear as a separate brochure or the institution concerned could make arrangements with the society journal to defray a part of the cost of publication. This latter plan has been successfully adopted by several recognized journals and research laboratories.

Present regulations, possibly instigated by the Government Printing Office, do not permit the participation of government laboratories in such a program, but if the majority of the scientific public were convinced that curtailing of the numerous *heterogeneous* government journals and the distribution of the material in national journals of homogeneous character were conducive to the scientific welfare of the country, it is quite possible that the iron-clad restrictions now existing could be partially removed.

In conclusion the writer wishes to emphasize that a large group of scientists in this country is convinced of the detrimental influence of privately published journals containing material of heterogeneous character, and the same objection, but with less serious consequences, applies to most academy proceedings. It would seem that the subject is of sufficient importance to warrant careful consideration by the governing boards of organizations and societies devoted to broad fields of research.

PAUL D. FOOTE

GULF OIL COMPANIES,
PITTSBURGH, PA.

FLAGELLUM DIVISION IN PARANEMA GLOBIFERUM

OWING to the fact that there prevails no little skepticism about the splitting of the flagellum in division of the Mastigophora, this observation is reported.

It is often rather difficult in our laboratory to obtain Euglena when desired, but another mastigophoran is very often used as a type because it is easily obtained in our cultures. This is *Paranema globiferum* (determined by Dr. R. W. Hegner, of Johns Hopkins), and the processes here described have been observed many times.

The first evidence of the beginning of longitudinal binary fission in these protozoa is the appearance of a forked flagellum. The forking increases until the organism appears to be biflagellate. Division of the body then begins, the gullet splits and in from five to ten minutes the new individuals separate and proceed in search of food which, under our observation, consisted of small algae (*Ophiocytium capitatum*).

CLYDE T. REED

TEXAS COLLEGE OF ARTS AND INDUSTRIES

A NEW GUINEA EEL-FAIR

THE ascent of fresh-water streams by vast swarms of elvers or young eels, long known as "eel-fairs" in England, is a phenomenon of great interest. The migrations of the Atlantic eels are now well known, thanks to the studies of a long line of naturalists, culminating in the epochal researches of Johannes Schmidt.

As yet little is known of the life histories of the numerous species of Anguilla found in the Indo-Pacific waters. It is therefore of interest to note that on May 24, 1928, we found an incredible number of young eels ascending the great Sepik River at Marienberg, New Guinea, which is about forty miles inland from the north coast. This is in former German New Guinea.

I measured 262 specimens, varying from 104 to 210 mm in length. Most of the eels observed were from 125 to 150 mm long, and quite slender. A moderate increase in length was accompanied by a very great increase in bulk.

The eels occurred in such numbers that the natives, men, women and children, scooped them up out of the river by basketsfull on both sides of the river. The Sepik at Marienberg is half a mile wide and fifteen to twenty-five feet deep at the bank; our ship, drawing thirteen feet of water, tied up to the shore.

Two days later only a few individuals were found in seining the tributary brooks where the young eels had occurred in myriads before.

This is the second eel-fair observed in New Guinea, the first seen being on February 22, 1922, in the Mamberamo River, Dutch New Guinea. This was inland a considerable distance from the north coast.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

MORE ABOUT LACTOPHENOL

IN two late numbers of SCIENCE[1] two contributors have called attention to lactophenol and its use. Lactophenol and lactophenol gum have been used for nearly eight years by the writer, his coworkers and students in the department of botany. This solution has been found an excellent medium for killing, staining and mounting microscopic materials, for these three processes may be accomplished in one process with green lactophenol.

However, for staining nuclei and differentiating hyphae in plant tissues, as wood and parenchyma, the sections were first submerged for ten minutes in lactophenol to which two parts of distilled water had been added; after this liquid was drained or blotted from the sections they were covered with deep acid green lactophenol and stored overnight in the open air. The liquid was again removed, the sections washed by floating clear lactophenol over them and then mounted in clear lactophenol or lactophenol gum. Hyphae in cells of fruit, wood and from germinating conidia were nicely differentiated by this method.

As investigators continue to employ this solution in zoological and botanical work, greater possibilities for a more extensive use may be forthcoming. If such be the case, they should be published for the benefit of all.

Details for the preparation of lactophenol and lactophenol gum together with references may be found in an article by W. H. Davis, "Lactophenol."[2]

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SPECIAL ARTICLES

A NEMATODE PARASITE OF THE JAPANESE BEETLE (POPILLIA JAPONICA NEWM.)

ON May 29, 1929, at the Tavistock Golf Course, Haddonfield, New Jersey, in a plot of ground two feet square the writers found fourteen dead, fully grown Japanese beetle grubs. These grubs were flaccid and of an ocherous brown tint. On dissecting the cadavers each one was found infected with numerous nematodes. Among these nematodes ovoviviparous females, males and larval forms were observed. On May 31, in the identical locality, nine more dead Japanese beetle grubs were found. These grubs had the same external appearance as the previous ones and were also heavily infested with the parasite.

On each of the two days following this observation eight fully grown Japanese beetle grubs from healthy stock were experimentally infected with worms derived from the parasitized grubs. One grub was placed in each of eight sterile tin salve cans containing soil which had been previously baked. The surface of the soil in each can was dampened with five drops of a heavy salt solution suspension of the nemas. An equal number of uninfected controls were held. Within five to seven days fifteen of the sixteen infected grubs

[1] SCIENCE, 70: 430, November 1, 1929; 70: 455, November 8, 1929.

[2] *Botanical Gazette*, 77: 343–344, 1924.

died. They were flaccid, of an ocherous brown color and were filled with the introduced nematodes. One infected grub and the sixteen controls pupated and transformed. This experiment was repeated towards the last of June with approximately identical results.

During the course of the first experiments some of the worms derived from the May 29 and 31 field collections were fixed and sent, on June 4, to Dr. G. Steiner, of the U. S. Department of Agriculture, for identification. Dr. Steiner informed us that the nematode was undoubtedly a parasite and not a saprozoic free-living form. It belongs to the family *Oxyuridae*, and has been described by Dr. Steiner as a new genus and species under the name of *Neoaplectana glaseri*.[1] Whether *Neoaplectana* accompanied the Japanese beetle to this country or is a usual parasite of some native insect, from which it has reached *Popillia japonica*, is not yet clear.

During the summer and early fall frequent examinations of living and dead grubs were made. Some of these were obtained from the original locality as well as from other sources in New Jersey and Pennsylvania. However, *Neoaplectana* was found in only one place, namely Tavistock, near Haddonfield. On June 15, one pupa from this station was found parasitized with *Neoaplectana*. On June 21, a reexamination of the small plot of ground where the nematodes were first found yielded three Japanese beetle grubs, two pupae and two adults, all parasitized. The adults seemed to have been in the process of emerging from the soil when stricken. The June 21 collection was the last *Neoaplectana*-parasitized material obtained. After this date the adults emerged and the next generation of grubs were too small and scarce for satisfactory work until about the last of August.

One dead second-stage larva obtained from Pitman, New Jersey, August 24, and three from Haddonfield September 17, were heavily infested with several species of nematodes that appeared smaller than the spring parasite. These nematodes were undoubtedly saprophytes which multiplied within the bodies of the grubs after they succumbed from other causes. We were able to cultivate several generations of these worms on hay infusion agar to which a small amount of coagulated horse serum had been added. The females of these worms laid eggs very freely on the medium. Healthy Japanese beetle grubs infected with these nematodes did not die, although they acquired the worms, probably per os, and maintained from one to six of them within their alimentary tracts for about two weeks. The saprophytic species were the only ones found throughout the early autumn, and they also apparently disappeared from the field after the middle of October.

[1] *J. Wash. Acad. Sci.*, 19: 436, 1929.

Neoaplectana appears to be ideally adapted as a parasite for the Japanese beetle, for the reason that the host spends most of its long life cycle in the ground, which is undoubtedly also the natural environment of the nematode during at least a portion of its existence. According to present indications the parasite still occurs locally. However, it possesses great reproductive and lethal capacities, and therefore might prove a valuable adjunct if distributed throughout the territory infested with the Japanese beetle.

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REVERSAL OF THE STIMULATING ACTION OF HYDROSTATIC PRESSURE ON STRIATED MUSCLE

THE application of hydrostatic pressure to striated muscle commonly results in a marked augmentation of the tension developed during a single twitch.[1] Pressures of the order of 1,000 pounds per square inch in our previous study caused an increase of about 30 per cent. in tension and heat production. Most of our work, however, has been carried out on cardiac muscle in which tissue the effects of pressure are greater and the results may be predicted with considerable confidence.[2] Certain observations made in the interim on striated muscle failed to show as great a stimulation as was reported earlier, and occasional preparations were entirely uninfluenced by pressure. A further study has therefore been undertaken on striated muscle in which the effects of various environmental factors have been investigated in relation to the magnitude of the response under pressure. The results, a preliminary report of which is here published, are of interest in relation to the theories of pressure action and to the general problem of muscular contraction.

All observations have been made on sciatic-gastrocnemius preparations from the frog by a technique previously described.[1]

When the muscle was immersed in an oxygen free Ringer's solution or in one in which the acidity had been increased to about a pH 6.8 by the addition of hydrochloric acid, a characteristic change was noted. At first pressure resulted in the usual augmentation

[1] McKeen Cattell and D. J. Edwards, *Am. Jour. Physiol.*, 86: 371, 1928.
[2] D. J. Edwards and McKeen Cattell, *Am. Jour. Physiol.*, 84: 472, 1928.

in the response of the muscle, but after successive applications of pressure there was no increase in tension above the control value. It was further observed that if a muscle, when immersed in an oxygenated normal Ringer's solution, was fatigued by repeated stimulation, its response under pressure was less than the control, *i.e.*, the action of pressure on the tension developed by the muscle in response to a single stimulus is opposite in direction to its action in a fresh preparation. It seems probable that oxygen lack and acid solutions produce their effects by promoting fatigue. The following points have been established regarding the reversal of the pressure effect in the fatigued muscle: (1) The degree of depressed is roughly proportional to the pressure employed. (2) The tension developed by the fatigued muscle is commonly reduced to about one half by a pressure of 1,600 pounds per square inch. (3) The response very quickly, possibly instantaneously, returns to the control value when the pressure is released.

In the case of cardiac muscle the stimulating action of pressure on the tension can no longer be obtained when the temperature is reduced to 5° C., and we have secured some evidence of a reversal occurring at that point. (In press, *American Journal of Physiology.*) Studies now in progress on striated muscle indicate that there is a critical point at approximately 13° C. at which the stimulating action of pressure passes into depression. At a few degrees below this temperature the depressive action becomes marked and becomes greater as the pressure is increased. A few preparations have shown, in the vicinity of the critical temperature, a stimulation under the lower pressures (1,000 pounds) and depression at higher pressures (2,100 pounds). As the temperature is lowered pressure causes a further reduction in the response until at about 1° C. high pressure (2,100 pounds) almost completely suppresses the development of tension. At room temperature the magnitude of the response of the muscle continues to increase with increasing pressure up to at least 2,100 pounds per square inch, which is the greatest pressure we have employed.

When pressure is released the muscle again responds with the development of tension, the record differing in no way from the control taken before the application of pressure to the cold muscle. When such a muscle is warmed to room temperature, pressure once more causes an increase in the development of tension corresponding closely with the result obtained before the muscle was chilled.

Measurements of the duration of the phases of contraction and relaxation of cardiac muscle show that moderate pressures result in only a slight prolongation of these periods, and the same appears to hold for striated muscle at room temperature. On the other hand, at the lower temperatures pressure causes, along with the depression in tension development, a striking prolongation in the duration of the phases of contraction and relaxation which, for the higher pressures, may reach 100 per cent.

Certain interesting differences of behavior between cardiac and striated muscle are indicated by these results. In the first place, it appears impossible to fatigue cardiac muscle in such a manner as to produce a reversal of the pressure effect such as occurs in striated muscle, and in the second place the critical temperature, in which reversal of the pressure effect occurs, is about 8° C. lower in cardiac muscle.

The significance of these results in relation to the mechanism of muscular contraction will be discussed at a later date in connection with the publication of the complete data.

SUMMARY

The usual augmenting action of pressure on the tension developed by striated muscle in response to a single stimulus changes to depression on fatiguing the muscle. On release of the pressure the tension of the single twitch again reaches the control value.

A similar reversal may be brought about by cooling the muscle, the change usually occurring at about 13° C. Below this temperature the depression is roughly proportional to the pressure. At about 1° C. the tension development may be completely inhibited by high pressure. The muscle responds normally upon release of the pressure, and upon warming pressure again causes augmentation of contraction.

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BOOKS RECEIVED

ALEXANDER, JEROME. *Colloid Chemistry.* Pp. x + 270. Third edition. Van Nostrand. $5.00.

GATES, R. RUGGLES. *Heredity in Man.* Pp. xiii + 385. 87 illustrations. Macmillan. $

ISABEY, JEAN. *Cours de Chimie.* Pp. 393. Illustrated. Gauthier-Villars. Paris. 70 fr.

LIDDELL, E. G. T., and CHARLES SHERRINGTON. *Mammalian Physiology:* A Course of Practical Exercises. Second edition. Pp. xi + 162. Oxford University Press. $5.50.

RITCHEY, G. W. *The Development of Astro-Photography and the Great Telescopes of the Future.* In French and English. 34 plates. Société Astronomique de France.

SMITH, T. V., and LEONARD D. WHITE, Editors. Chicago: *An Experiment in Social Science Research.* Pp. xi + 283. University of Chicago Press. $3.00.